

TYPHOON ROY (01W)

Typhoon Roy was the first significant tropical cyclone of 1988 in the western North Pacific. It formed as a "twin" (Figure 3-01-1) with its southern hemisphere counterpart, Tropical Cyclone 07P (Anne). During a period of eleven days in January, Roy made a 4000 nm

(7408 km) westward trek, caused significant damage on Kwajalein Atoll and the islands of Guam and Rota, crossed the Philippine Islands and dissipated over the South China Sea. Typhoon Roy's close approach to Guam resulted in the most destruction since Super

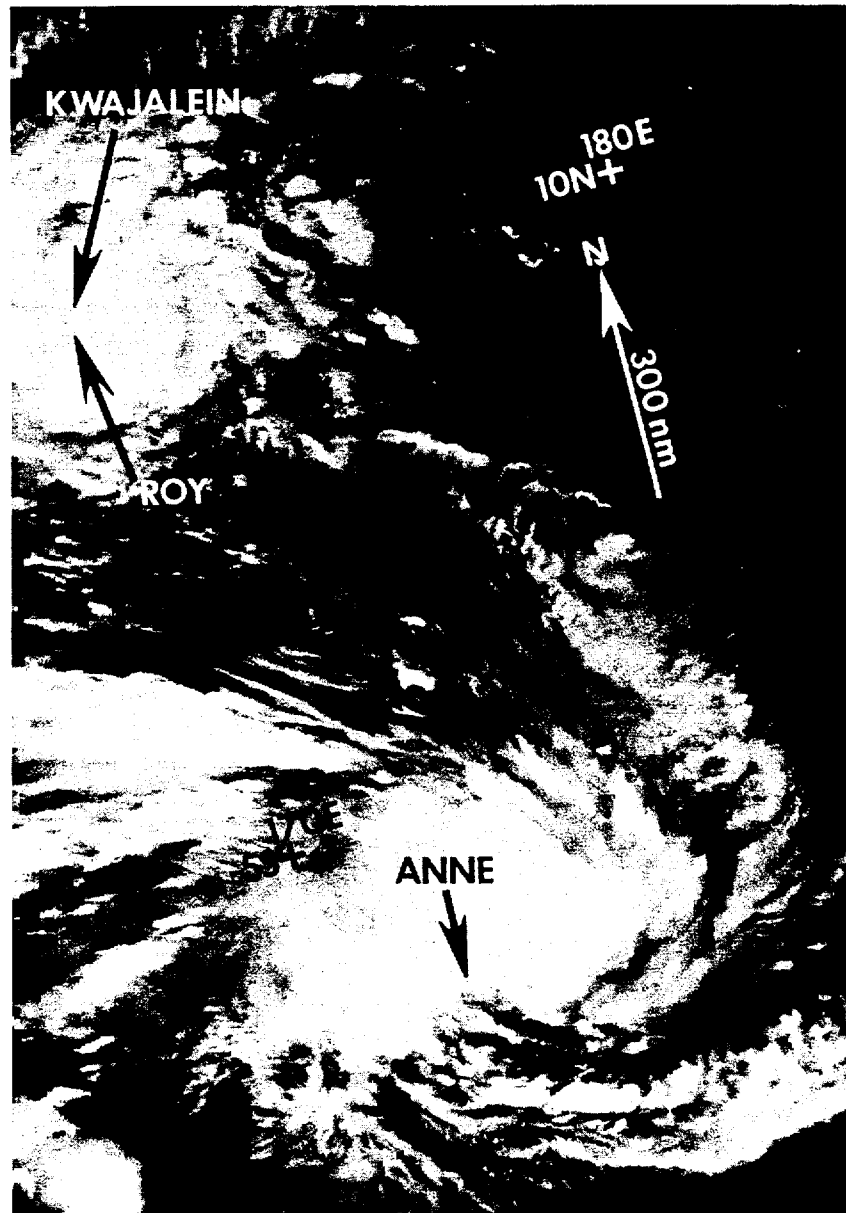


Figure 3-01-1. Typhoon Roy (01W) with its southern hemisphere counterpart, Tropical Cyclone 07P (Anne) (081957Z January NOAA infrared imagery).

Typhoon Pamela (1976).

Prior to tropical cyclone genesis, above normal sea surface temperature anomalies and greater than normal cloudiness persisted in the central Pacific Ocean. Roy began in this area of increased cloudiness southeast of the Marshall Islands, with persistent convection first noted on the Significant Tropical Weather Advisory at 060600Z. The suspect area was mirrored by another area of persistent convection in the southern hemisphere, which developed into Tropical Cyclone 07P (Anne). A band of anomalous low-level equatorial westerlies was located between the two cloud systems. Gradient-level wind reports from Tarawa (WMO 91610) in the Kiribati Islands during early January consistently indicated moderate westerly winds. (Climatic windflow at Tarawa for January is east-northeasterly at 12 kt (6 m/sec).)

By 7 January, Roy's cloud organization had improved and JTWC issued a Tropical Cyclone Formation Alert at 072000Z. Satellite intensity technique estimates of 30 kt (15 m/sec) combined with synoptic reports of 30 kt (15 m/sec) surface winds and a 997 mb surface pressure from Majuro (WMO 91376) prompted the issuance of the first warning on Tropical Depression 01W at 080000Z. (Tropical Cyclone 07P (Anne) in the southern hemisphere reached tropical storm intensity 12-hours earlier). As Tropical Depression 01W moved north of Majuro, the island experienced maximum sustained winds of 35 kt (18 m/sec) with gusts to 45 kt (23 m/sec), and several buildings suffered minor structural damage.

Satellite reconnaissance continued to detect deepening of the system and Tropical Depression 01W was upgraded to a tropical storm at 080600Z. Roy (Figure 3-01-1) passed 35 nm (65 km) south of Kwajalein Atoll at 081800Z. Kwajalein Island (WMO 91366) reported maximum sustained winds of 48 kt (25 m/sec) with a peak gust of 57 kt (29 m/sec), a minimum sea-level pressure (MSLP) of 992 mb and light-to-moderate structural damage. Ebeye

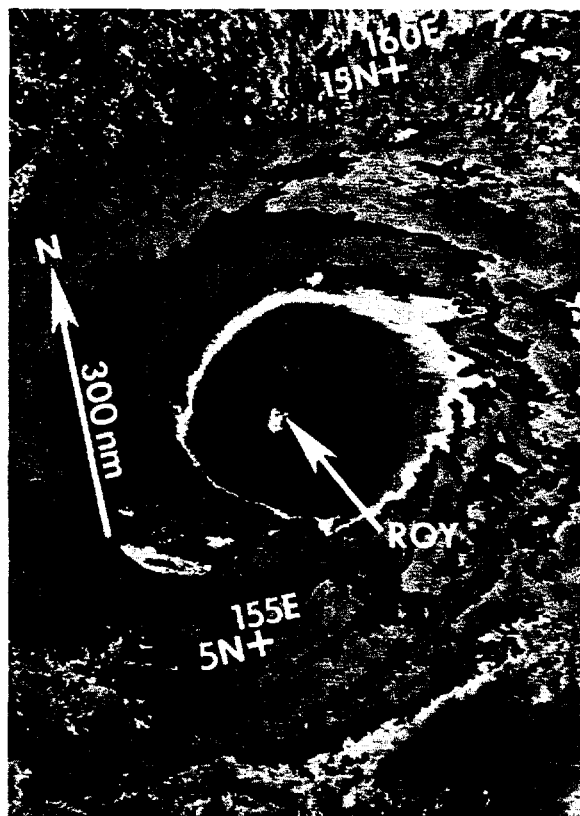


Figure 3-01-2. Roy (01W) near peak intensity (100823Z January DMSP enhanced infrared imagery).

Island just 4 nm (7 km) to the north experienced moderate-to-severe structural damage, one death and loss estimates of five million dollars. Both islands had 20 to 22 ft (6.1 to 6.7 m) surf and low-lying areas were flooded. Using their weather radar, meteorologists on Kwajalein were the first to detect the formation of Roy's eye at 081000Z. Later at 091200Z, a satellite estimate of 65 kt (33 m/sec) resulted in the upgrade to typhoon intensity.

While at a forward speed of 22 kt (41 km/hr) at 101200Z, Roy (Figure 3-01-2) reached a peak intensity of 115 kt (59 m/sec) 510 nm (945 km) east-southeast of Guam. The typhoon was embedded in a moderate mid-tropospheric east-southeasterly flow south of the subtropical ridge axis, as indicated by aircraft reports at 500 mb (Figure 3-01-3). Then Typhoon Roy slowed to 12 kt (22 km/hr) as it approached Guam (Figure 3-01-3). Detachment 2, 20 Weather

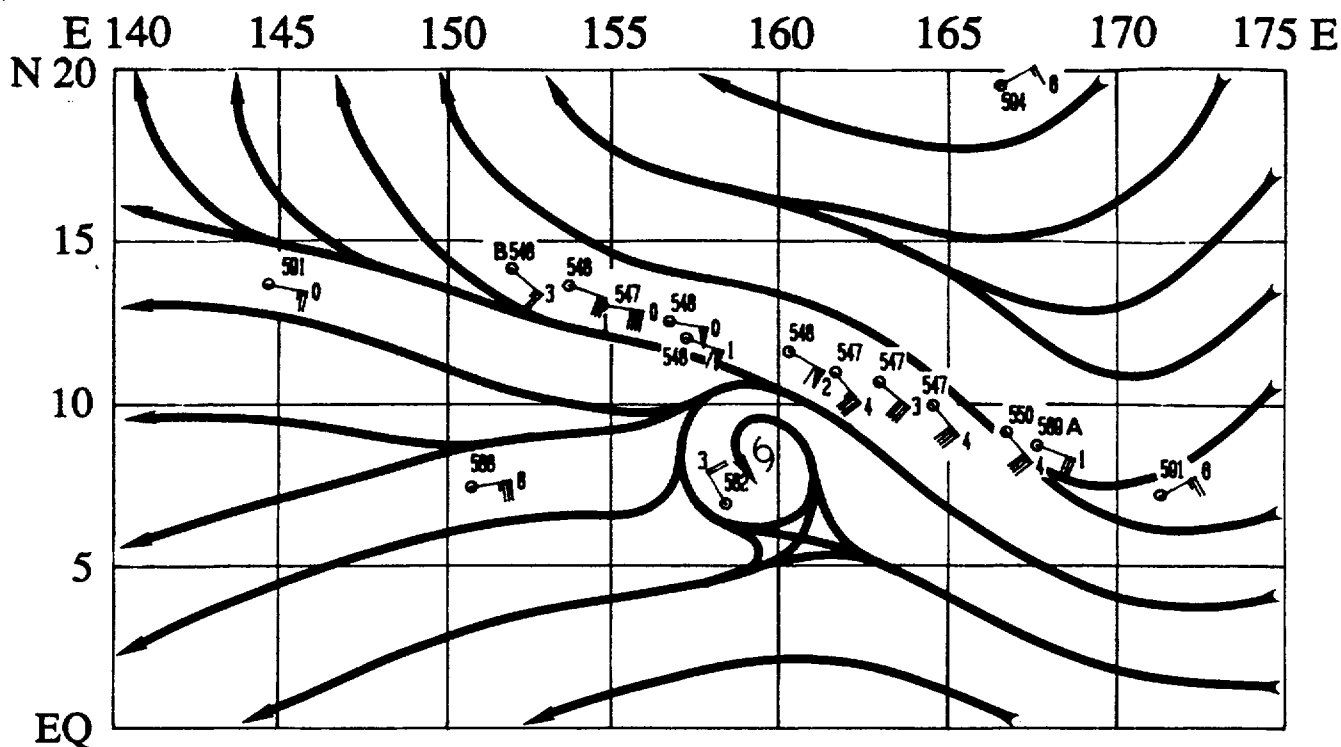


Figure 3-01-3. 100000Z January 500 mb streamline analysis with additional reports along the aircraft track to the north of Roy. The aircraft reports are from point A (100057Z) to point B (100340Z).

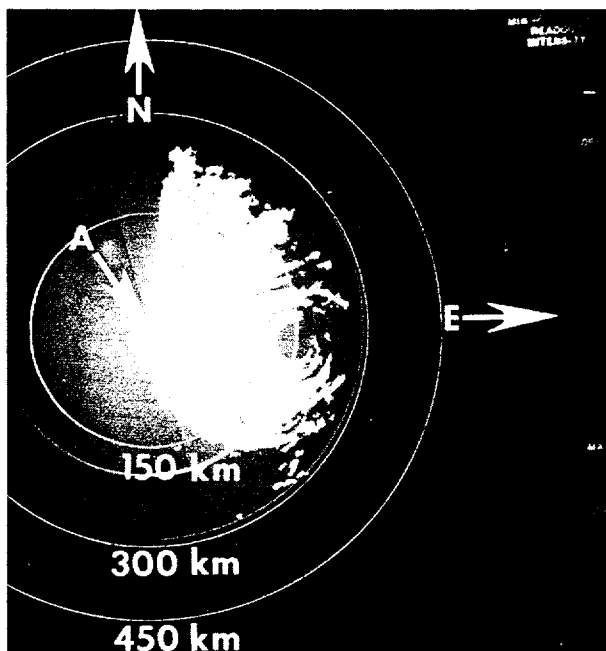
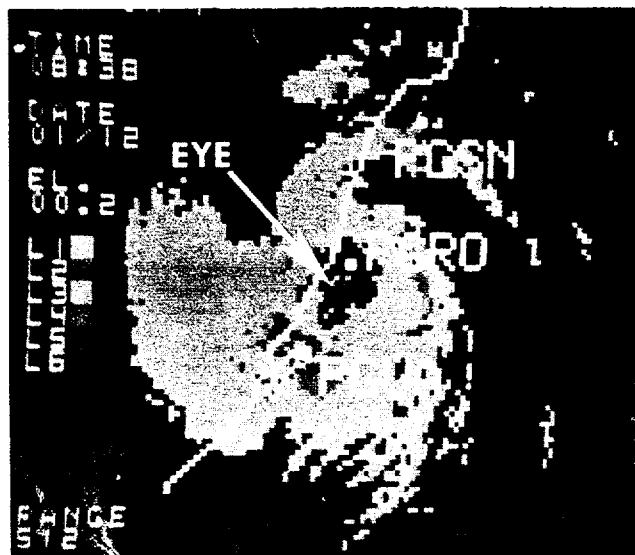


Figure 3-01-4. Spiral rainband echoes define the typhoon's eye at 112310Z January 120 nm (222 km) east-southeast of the radar site. The weather radar (at point A) is located at Andersen Air Force Base on the northeastern tip of Guam (photo courtesy of MSgt Robert W. Yates and Detachment 2, 20th Weather Squadron).

Figure 3-01-5. 110838Z January digitized radar display of Roy's rain shield. Note the island of Rota (call sign PGRO) lies within the ragged eye. The call sign PGUA marks the location of Andersen Air Force Base on Guam and PGSN the airfield on Saipan (photo courtesy of MSgt Robert W. Yates and Detachment 2, 20th Weather Squadron).



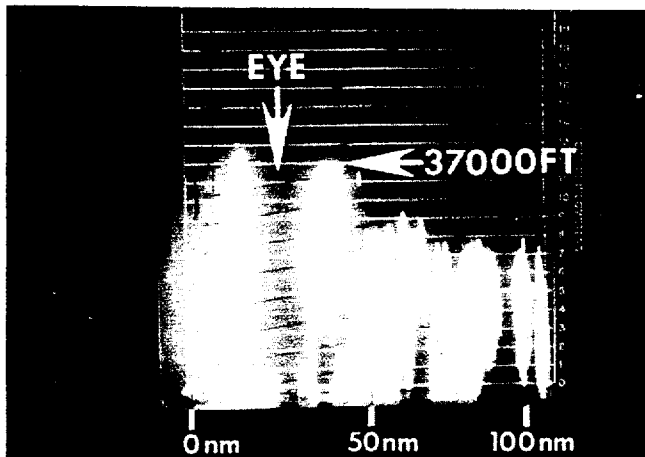


Figure 3-01-6. At 110838Z January the Andersen Air Force Base weather radar display paints 37,000 feet (11.3 km) rain echo tops in the outer eye wall cloud. The radar returns in the lower left of the picture and closest to the radar site are attenuated due to heavy rain (photo courtesy of MSgt Robert W. Yates and Detachment 2, 20th Weather Squadron).

Squadron at Andersen Air Force Base on Guam first detected the eye on radar at 111930Z (Figure 3-01-4). These weather radar data were instrumental in tracking Typhoon Roy's center, as it made its closest point of approach (Figures 3-01-5 and 3-01-6) 32 nm (59 km) north of Guam at 120930Z. Wind estimates near the center were 110 kt (57 m/sec). However, Andersen Air Force Base on the northeastern tip of Guam measured maximum sustained winds of 66 kt (34 m/sec) with peak gusts to 98 kt (50 m/sec) as the eye wall passed just to the north. Buildings, particularly those on the northern part of Guam, sustained light-to-moderate structural damage (Figure 3-01-7). Crops and vegetation on Guam suffered extensive damage, with estimates of losses as high as 23.5 million dollars. As a credit to the disaster preparedness team, no severe injuries or loss of life were



Figure 3-01-7. Roy almost went on a shopping spree as indicated by the structural damage to the Andersen Air Force Base commissary on Guam.

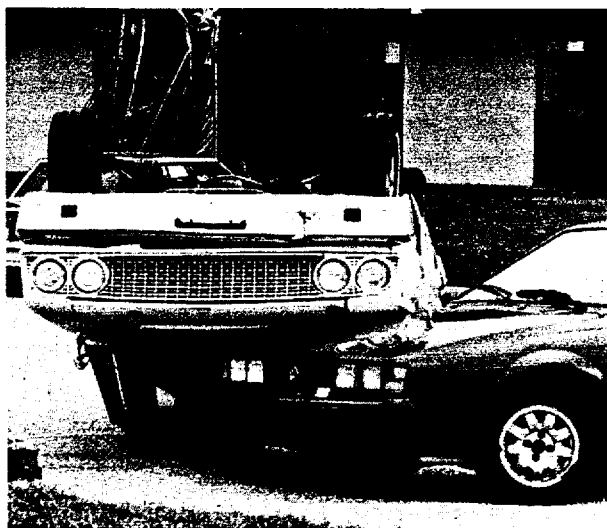


Figure 3-01-8. Strong winds rearranged these parked vehicles.

reported on Guam (Figure 3-01-8).

In comparison, the island of Rota, 40 nm (74 km) north-northeast of Guam, suffered the heaviest damage. At 120724Z, shortly before eye passage, Rota's automated weather observing equipment reported maximum sustained winds of 71 kt (37 m/sec) with peak gusts to 104 kt (54 m/sec). Because of apparent communication problems, no further data were received until the 120905Z report of 60 kt (31 m/sec) with gusts to 89 kt (46 m/sec). Residents of Rota described the eye passage as a marked lessening of wind speed and clearing skies from 120730Z to 120810Z. Concurrently, a microbarograph trace from the Naval Oceanography Command Detachment, Agana, located on central Guam indicated a minimum sea-level pressure of 979 mb from 120800Z to 121000Z (Figure 3-01-9). A large percentage of the homes on Rota were destroyed and the remainder damaged. Four minor injuries were reported, which resulted when a flying roof impacted another building where people had sought shelter. Numerous coconut trees were downed and all crops destroyed. With an estimated 95 percent of the utility poles knocked down, lack of power and potable water completely disrupted the community.

After moving through the southern Marianas, Roy continued to slow. Earlier analysis of 500 mb aircraft reports revealed a mid-tropospheric anticyclone east of the Philippine Islands with ridging extending to the northeast of Roy's center. As Typhoon Roy approached the Mariana Islands, it apparently responded to the weaker mid-level steering flow and decelerated. A weakness in the subtropical ridge was located almost due north of Guam. It was initially thought that Roy would weaken the subtropical ridge and ultimately recurve. However, this did not happen. Instead, the lower tropospheric ridge built, as reflected by 700 mb pressure-height rises at Iwo Jima (WMO 47971). In turn the typhoon accelerated to the southwest. (By this time, Roy's maximum sustained winds had weakened to 90 kt (46 m/sec). This intensity was maintained until reaching the mountainous terrain of southern Luzon.)

At 141800Z, Roy returned to a more westward course along the southern edge of the subtropical ridge and increased its speed of 20 kt (37 km/hr). From 160000Z to 170000Z, Roy tracked across southern Luzon. The mountains and increased vertical wind shear further

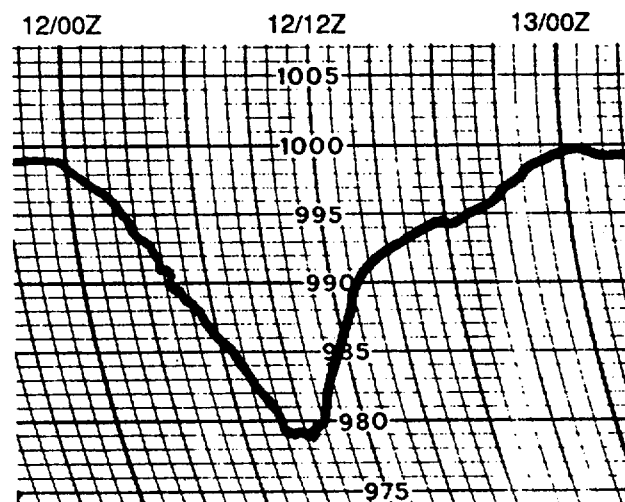


Figure 3-01-9. Microbarograph (pressure) trace of Typhoon Roy (01W) recorded at the Naval Oceanography Command Detachment, Agana, Guam indicates a minimum sea-level pressure of 979 mb from 120800Z to 121000Z January.

weakened Roy from 75 kt (39 m/sec) to 40 kt (21 m/sec). Once in the South China Sea, Roy's interaction with the low-level northeasterly flow

of the winter monsoon spawned gales, but dissipation was imminent. At 171200Z, Tropical Storm Roy was downgraded to a

tropical depression and the final warning followed at 180000Z.